MESA: Supporting Software Development with Coordinated Scientific Input

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The Mission Engineering and Science Analysis (MESA) Group provides dedicated scientific support to the major software development projects at STScI. Facilitating the communication between scientists and developers has proven beneficial for the efficient utilization of the resources and to meet, in a timely manner, the scientific objectives of STScI's missions. We will present an overview of the projects currently under the purview of MESA.

Background

MESA has been functioning for two years now [1,2]. MESA successfully supports a large number of projects that affect more than one team, mission, or division. MESA handles collaborations through permanent working groups staffed and in many cases led by instrument teams or engineering. The diagram below provides a list of all the WGs, each taking a slice of the MESA pie. These WGs support sponsored studies and high priority projects, many of which are highlighted in the boxes connecting to a given MESA WG.

MESA focuses on small, medium, and large JWST and HST activities. Each members of the MESA Group participates in one or several working groups or studies providing expert scientific and technical knowledge, support, and coordination of work when needed. This multifaceted framework is needed in order to realize the cross team, cross project, and cross mission benefits. Our strategy is:

- Maintain scientific and technical knowledge of many of the JWST and HST systems, such that we can provide immediate feedback to developers and scientists.
- Maintain detail knowledge of the work that science and technical teams working on HST and JWST do. This allow us to identify the best team to address any questions or issues we cannot address.
- Keep working on both missions, HST and JWST, such that we can help STScI to realize cross mission benefits.
- Participate in several studies without focus on the particular work of an instrument or team. In doing so, we can identify where the work in one area could benefit others, identify where priorities of work need to be elevated, and how the success of one group can trickle down to the work and success of other teams.
- Maintain knowledge of critical schedules and deadlines and help projects coordinate their work.

MESA's sponsored studies & projects

JWST Flight Operations

- Coordinate science input to the onboard script development process.
- Supporting studies for target location algorithms
- Supporting studies for operational changes needed to accommodate JWST Science

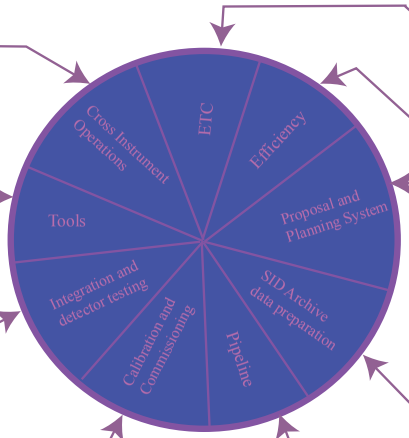
Other Activities

Identify science techniques that can be developed at STScI and that will increase the science return of data taken by HST and JWST.

- Design and Coordinate the creation of the analysis tools in particular for JWST(see poster by H. Ferguson) but also extending the current set for HST.
- Participate on studies to identify publishing platforms for HST and JWST documentation
- Oversee of the science products of the Hubble Legacy Archive (HLA, http://hla.stsci.edu/)
- Work on the design of the Hubble Source Catalog (HSC, https://archive.stsci.edu/hst/hsc/)
- Support design and creation of the HST Spectroscopic Legacy Data
- Work on documentation, handbooks; explore publishing options for HST and JWST

Detector Integration & Test

- Studies of NIR Detectors to determine effects like: gain on S/N, implications on the flux due to net bias, low and high flux, flat exposures, persistence, background, etc.



Proposal and Planning System

- Exposure Time Calculator design and development coordination for all JWST and HST instruments.
- Science input to JWST APT development as it relates to requirements for operation concept for Web application, integration with ETC, timely implementation of capabilities needed for other studies, etc.
- Oversight and coordination of the maintenance and updates of the JWST Science Operation Design Reference Mission (SODRM). The SODRM is a suite of representative observing programs that feeds into studies related to data volume, momentum management, and all aspects of observing efficiency.
- Exploring needed support for new strategies; e.g. PSF library for JWST
- Contributing to the design of JWST observation templates
- Proposal Instruction Review for JWST
- Propose proposal and planning system functionality from a JWST science perspective and improvements for HST.
- Coordinate the development of JWST observation templates in accordance to the Science requirements.
- Studies to identify the best strategies for JWST parallel observations.

Data Management Systems (DMS)

- Maintain master schedules for definition, development and testing of all the JWST calibration pipelines.
- Define calibration algorithms for all the JWST data and instruments and provide calibration reference data.
- Define reference files format and content for all the JWST instruments. Define procedures and expected accuracy of testing of calibration steps.
- Coordinate pipeline testing efforts and documentation.
- Assisting DMS as they implement the JWST calibration and processing pipelines, define science and engineering data databases, create and archive data and products.
- Participate in relevant designs for the management, processing and ingest of JWST data
- Prepare JWST ground test data for ingest into the SID archive. Support Archive with development of the archive interface. Support collaborative efforts between SI teams.
- Coordinate the development, test, and update of documentation of the HST Python based Synthetic Photometry (pysynphot) software package.
- Support, coordinate and test the migration of the HST reference data system to the new system: CRDS.
- Keep an eye on the activities related to the development plans and testing of the HST instruments pipelines and identify areas that require our attention.

[1] https://blogs.stsci.edu/newsletter/2013/03/29/the-origin-of-mesa/
[2] R. Diaz, 2014, in *Astronomical Data Analysis Software and Systems XXIII , ADS, ed. Manset, N & Forshay, P., Vol 485, p29*